PATENT
GM Ref. No. GP-301332
HDP Ref. No. 8540G-000091

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Group Art Unit:	1745
Examiner:	Helen Chu
Inventor:	Mathias et al.
Serial No.	10/643,061
Filed:	8/18/03
For:	DIFFUSION MEDIA FOR USE IN A PEM FUEL CELL

APPLICANT'S APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the final rejection mailed November 28, 2006, for which Appellant filed a Notice of Appeal on March 26, 2007. This Brief is submitted along with the fee due under 37 C.F.R § 41.20(b)(2).

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TABLE OF AUTHORITIES

Real Party in Interest

The real party in interest is GM Corporation, having a place of business at 300 Renaissance Center, Detroit, Michigan 48265, to which the inventor has assigned all rights in this invention. The assignment was recorded in the United States Patent and Trademark Office on November 25, 2003, at reel/frame: 014413/0864.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 1-25 are pending. Claims 1-10 stand rejected under 35 USC § 102(b) based on Denton et al. (US Patent 6,010,606). Claims 11-25 have been withdrawn from consideration and are drawn to an unelected invention.

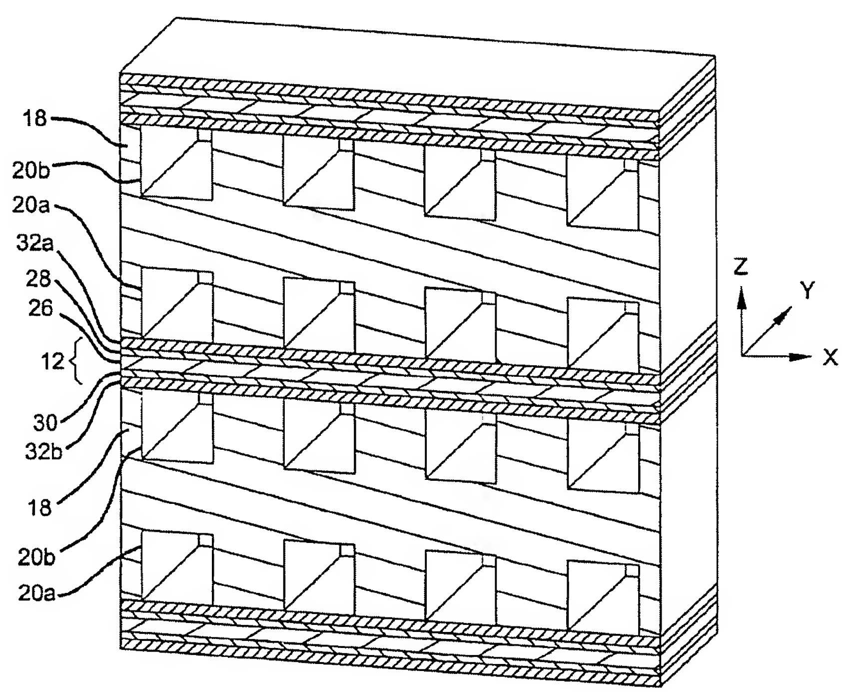
Status of Amendments

There have been no amendments since the final rejection.

Summary of Claimed Subject Matter

Independent claim 1 is drawn to a proton exchange membrane (PEM) fuel cell including an electrode plate 14 and a membrane electrode assembly 12. Page 5, lines 16-18; Fig. 1. A flow field (with lands 18, flow channel 20) is formed within the electrode plate 14. Page 6, lines 1-4; Fig. 1, Fig. 2. The membrane electrode assembly includes a permeable diffusion media 32a, 32b that has a substantially incompressible thickness and is disposed adjacent the electrode plate 14. Page 3, lines 20-23; Fig. 2. The permeable diffusion media 32a, 32b is rigid along a transverse axis and flexible along a lateral axis. Page 3, lines 20-23. The transverse axis crosses first channels of the flow field where the first channels define a predominate flow direction. Page 6, lines 1-4; page 7, lines 8-12.

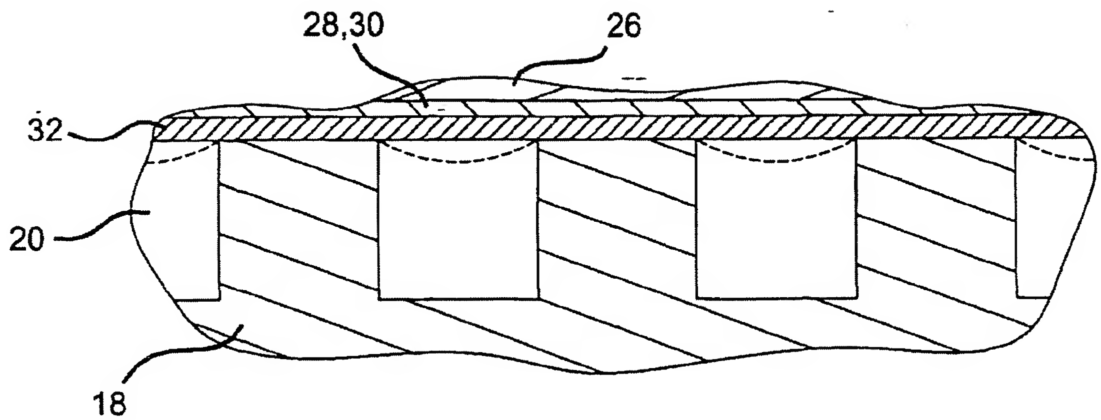
Reproduced below is Figure 2 from the present specification, which shows a partial perspective cross-sectional view of a portion of the PEM fuel cell stack.



Referring to Figure 2, the diffusion media 32a, 32b diffuses the fuel cell reactants (i.e., H_2 and O_2) as well as the reaction products (i.e., H_2O) across the electrode face. Page 7, lines 25-45. In this manner, the reactants are able to flow from the flow channels 20a, 20b through the diffusion media and into contact with their respective catalysts for enabling the required reaction. Page 7, lines 25-45. The x-direction (see axis legend in FIG. 2 above), or the transverse axis, is in plane and perpendicular to the flow channels 20, while the y-direction, or lateral axis, is also in plane but parallel to the flow channels 20. Page 7, lines 15-23.

The diffusion media 32 is anisotropic, whereby the properties are not the same in the x-, y-, and z-directions. Page 8, line 15 to page 11, line 5. As claimed, the transverse axis (x-direction) is rigid and the lateral axis (y-direction) is flexible. Thus, the diffusion media is easily rollable along the flexible lateral axis (i.e., the y-direction) to facilitate manufacture and transportation. Page 8, line 15 to page 9, line 13 and page 10, line 27 to page 13, line 5. On the other hand, the diffusion media will not impinge or tent into the flow channels 20 along the rigid transverse axis (i.e., the x-direction). Page 8, line 41 to page 9, line 13; Fig. 3. Thus, the diffusion media of claim 1 prevents tenting that would cause an undesirable pressure drop within the flow channels 20 and reduced electrical contact with the catalyst layer, thereby reducing fuel cell performance. Page 8, line 41 to page 9, line 13.

FIG. 3, reproduced below, shows how the rigid transverse axis prevents the diffusion media 32 from impinging into the flow channels 20 or pulling away from its respective catalyst layer 28, 30. Page 3, line 38 to page 4, line 7; page 7, lines 15-23; page 8, lines 15 to page 9, line 13; & page 10, line 27 to page 11, line 5.



The stippled lines shown sagging into the channels 20 in FIG. 3 illustrate the case where a diffusion media 32 would not have a rigid transverse axis and subsequently could impinge or tent into the channels.

In sum, claim 1 is drawn to a PEM fuel cell with a permeable diffusion media that is flexible along a lateral axis and rigid along a transverse axis. As disclosed in the specification, the transverse axis must be sufficiently stiff or rigid such that it does not impinge or tent into the flow channels. As claimed, the transverse axis of the diffusion media is rigid. Thus, rigid has its typical meaning of stiff. See *Phillips v. AWH Corporation*, 415 F.3d 1303, 1313, 75 USPQ2d 1321, 1326 (Fed. Cir. 2005) (en banc) (the primary basis for construing a claim term is the specification). Moreover, the present specification and claims contrast the rigid transverse axis with the flexible lateral axis. Thus, "rigid" and "flexible" have their normal and customary meanings.

Grounds of Rejection to be Reviewed on Appeal

Claims 1-10 stand rejected under 35 U.S.C. §102(b) as allegedly unpatentable over Denton et al. (U.S. Patent No. 6,010,606).

Argument

The Denton patent does not anticipate claims 1-10 because the Denton diffusion media is flexible regardless of direction, and thus the Denton patent does not teach or disclose a PEM fuel cell comprising diffusion media rigid along a transverse axis. It is an object of the Denton reference to provide a gas diffusion electrode with both increased dimensional stability and flexibility. Denton col. 3, lines 7-9; and col. 4, lines 32-35. The electrode may be formed by taking a non-woven fiber material and applying a catalyst coating that includes catalyst and polymeric material to form a flexible matrix. Denton col. 4, line 66 to col. 5, line 3; and see Denton claims 1, 16, 32, 48, and 49. The Denton teachings are said to overcome a major problem with conventional gas diffusion electrodes, in that conventional electrodes lack flexibility and are easily damaged on handling. Denton col. 2, lines 50-55; col. 3, lines 6-9. Compare, for example, the rigid conventional-type electrodes of "pre-teflonated" conducting carbon fiber paper with the Denton electrode. Denton col. 6, lines 22-29. As such, Denton teaches flexible electrodes.

Notably, there is no directionality associated with the flexible Denton gas diffusion electrode. The electrode appears to be highly flexible regardless of axis and orientaion. Moreover, nowhere does Denton discuss directionally in any physical properties of the electrode, much less attribute opposite characteristics such as flexible and rigid, between a transverse and a lateral axis of the electrode and an associated flow field.

The only mention of directionality regarding the Denton disclosure is in reference to the fibers. The Denton electrode is made of non-woven fibers, and the fibers themselves may be isotropic or anisotropic, depending on their alignment. Denton col. 3, lines 40-50. For example, methods of laying down the layer can impart a directional force (e.g., by extrusion) which can align fibers. Denton col. 3, lines 45-50. However, the overall Denton electrode is dimensionally stable but highly flexible. Denton col. 3, lines 40-51; col. 4, lines 32-34; and see Denton independent claims 1, 16, 32, 48, and 49 all pertaining to a flexible layer of non-woven fibers. No benefit, effect, or property is attributed to either randomly oriented or anisotropic fibers. Fiber orientation appears to simply be a product of the fabrication method.

In contrast, the present claims are drawn to a fuel cell in which the diffusion media has rigid transverse axis crossing the channels of the flow field. Denton teaches away from a rigid axis, teaching an electrode said to be highly flexible. To anticipate a claim the reference must teach every element of the claim. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). In the present case, the Denton reference fails to disclose all the features of Appellant's claims and, therefore, is not an anticipatory reference.

The Denton patent uses the term "dimensionally stable" to mean a diffusion media that is not stretchable, Denton col. 4, lines 32-35; col. 3, lines 7-9, not as the Examiner alleges, to mean rigid. "Dimensionally stable" in Denton refers to the resistance of the electrode to planar dimensional change (in the x and y directions) due to stretching. Denton col. 2, lines 56-60. In fact, Denton recognizes a major problem with conventional gas diffusion electrodes based on woven cloth substrates is that they

lack good dimensional stability as the cloth can be stretched in the x and y directions. Denton col. 2, lines 56-60. Denton's solution is a flexible electrode resistant to stretching. As such, Denton identifies "flexibility" and "dimensional stability" as both properties of its diffusion media that are advantageous compared to rigid and stretchable conventional electrodes.

Denton's dimensional stability therefore has nothing to do with rigidity. Denton discloses that "dimensional stability" only refers to stretching resistance. The Denton teachings do not support the Examiner's statements in the Office Action mailed November 28, 2006 at the top of page 5, where the Examiner appears to allege that dimensional stability comports with rigidity. Such an inference is not supported by the use of the term in the Denton specification. Denton is expressly trying to overcome the rigidity of the conventional electrodes. *Cf.* Denton col. 6, lines 22-29 and col. 2, lines 50-52 versus col. 3, lines 6-9 and col. 4, lines 32-34.

Denton's unstretching diffusion media is flexible not rigid. An analogous material that is both highly flexible and dimensionally stable, as defined in Denton, is a piece of paper – it can be rolled or bent anywhere along its planar surface, as it is highly flexible, but it cannot be stretched within its x and y dimensions (i.e., planar surface). However, a piece of paper is not rigid. Consequently, the statement on pages 4 to 5 of the final Office Action that "if one cannot easily stretch an object it would [sic] stable" is correct, but this statement and the language used in Denton have nothing to do with rigidity.

The Denton electrode cannot be both flexible and rigid. Dimensionally stable, as used in Denton, does not require rigidity. In contrast, Appellants' rigid transverse axis avoids tenting. Page 10, line 27 to page 11, line 5; and see Advisory Action mailed

March 9, 2007. As a result, the presently claimed diffusion media will not impinge or tent into the flow channels along the rigid transverse axis (i.e., the x-direction) as it is sufficiently stiff. Page 8, line 41 to page 9, line 13; and see the stippled line in FIG. 3, reproduced in the Summary of Claimed Subject Matter above.

In the Advisory Action from March 9, 2007, the Examiner misconstrues "dimensionally stable," (i.e., resistant to stretching), as synonymous with "avoiding tenting," and consequently draws the mistaken inference that "dimensionally stable" is the same as "rigid". However, the use of the verb form of "tent" in the present specification has nothing to do with stretching ability. "To tent" into the channels does not require that the diffusion media stretches; in the present specification it simply means that it will not impinge into the channels. Page 8, line 41 to page 9, line 13. The Examiner's reasoning is contradictory to the ordinary and customary meaning of these words.

Finally, in the present case it is improper to import terms from the Lawheed reference (U.S. Patent 6,672,064) as done by the Examiner on page 5 of the Office Action mailed November 28, 2006. There is no ambiguity regarding the definition of "dimensionally stable" in Denton. Denton expressly uses "dimensionally stable" to refer to a material's resistance to stretching. Denton col. 2, lines 56-60. As such, there is no reason to import alternative meanings for "dimensionally stable" from other references. Compare, *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250, 48 USPQ2d 1117, 1122 (Fed. Cir. 1998) ("Where there are several common meanings for a claim term, the patent disclosure serves to point away from the improper meanings

and toward the proper meanings."); and see *Phillips v. AWH Corporation*, F.3d 1303, 1313, 75 USPQ2d 1321, 1326 (Fed. Cir. 2005) (en banc).

Denton does not anticipate Claims 1-10. These claims are drawn to a PEM fuel cell comprising permeable diffusion media that is rigid along a transverse axis crossing the channels of the flow field. Denton is silent as to this feature, and in fact, the Denton electrode is highly flexible without regard to axis or direction. As Denton is missing this feature the reference cannot anticipate claims 1-10.

For these and the other reasons discussed above, Applicant respectfully requests that the rejection of Claims 1-10 be REVERSED.

Respectfully submitted,

Dated: May 25, 2007

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Claims Appendix

1. A PEM fuel cell comprising:

an electrode plate having a flow field formed therein; and

a membrane-electrode assembly including permeable diffusion media disposed adjacent said electrode plate, said permeable diffusion media being rigid along a transverse axis, flexible along a lateral axis and having a substantially incompressible thickness, wherein said transverse axis crosses first channels of said flow field, said first channels defining a predominate flow direction.

2. The PEM fuel cell of claim 1, wherein said permeable diffusion media is electrically conductive.

3. The PEM fuel cell of claim 1, wherein said permeable diffusion media comprises a first plurality of fibers substantially aligned along said transverse axis, a second plurality of fibers substantially aligned along said lateral axis, and wherein each of said first plurality of fibers is larger than each of said second plurality of fibers.

4. The PEM fuel cell of claim 3, wherein each of said first plurality of fibers is of a larger diameter than each of said second plurality of fibers.

5. The PEM fuel cell of claim 3, wherein each of said first plurality of fibers is of a greater length than each of said second plurality of fibers.

6. The PEM fuel cell of claim 3, wherein each of said first and second plurality of fibers comprise carbon.

7. The PEM fuel cell of claim 3, wherein each of said first and second plurality of fibers comprise graphite.

8. The PEM fuel cell of claim 3, wherein each of said first plurality of fibers is carbon or graphite and each of said second plurality of fibers is carbon or graphite.

9. The PEM fuel cell of claim 1, wherein said permeable diffusion media further comprises a plurality of strips substantially aligned along said transverse axis.

10. The PEM fuel cell of claim 9, wherein each of said plurality of strips is made of stainless steel.

Evidence Appendix

There is no evidence submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132.

Related Proceedings Appendix

There have been no related appeals and interferences and therefore no related decisions exist.